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(Article begins on next page)

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Laparoscopic Nephron-Sparing Calycectomy for Treating Fraley's Syndrome

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Keywords

Laparoscopy · Retroperitoneoscopy · Kidney · Nephron sparing surgery · Renal pelvis · Stenosis · Surgical repair · Surgical technique

Abstract

Background/Aims/Objectives: Various nephron-sparing approaches were described as part of surgical management for Fraley's syndrome, a rare anatomic variant of the renal vascular anatomy that compresses the upper pole infundibulum resulting in an upper calyceal obstruction and dilatation, with symptoms of flank pain and hematuria. To date, descriptions of minimally invasive correction techniques are anecdotal. **Methods:** A retroperitoneal pure laparoscopic approach using the nephron-sparing technique was chosen in the presented case. **Results:** In this report, we demonstrated that if laparoscopic calycectomy is performed without clamping of renal branches, parenchymal ischemia can be completely avoided. Additionally, the preservation of renal tissue surrounding the calyx enables the preservation of the intrasinus segmental arteries flow, thereby avoiding their accidental closure by hemostatic sutures. **Conclusions:** In conclusion, Laparoscopic Nephron-Sparing Calycectomy is a safe and effective surgical procedure for the treatment of Fraley's syndrome. Consistent laparoscopic experience is required before embarking on this kind of surgery.

Introduction

In 1966, Fraley described a rare anatomic variant of the renal vascular anatomy that compresses the upper pole infundibulum resulting in an upper calyceal obstruction and dilatation, with symptoms of flank pain and hematuria [1].

The Fraley's syndrome diagnosis is confirmed by urography through which a well-defined filling defect in the infundibulum, caused by the crossing vessel compression

is detected. The upper calyx looks distended.

Various treatment methods have been employed successfully to eliminate symptoms, usually requiring surgical exploration. Different open nephron-sparing approaches were described by several authors [2–4]. To date, descriptions of nephron-sparing laparoscopic or robot-assisted correction techniques of Fraley's syndrome are anecdotal [5].

Clinical Case

We present the case of a 46-year-old female with recurrent urinary tract infections with left pyelonephritis. Screening urinalysis revealed the presence of microscopic hematuria. Ultrasonography showed left upper calyx enlargement, and CT scan with urography revealed the presence of a crossing vessel at the left upper pole infundibulum resulting in a hydrocalycosis. The nuclear renal scan demonstrated that the tracer persistence collected in the left upper pole calyx even if the remnant kidney drained it promptly. Prior to surgery, a 3D reconstruction based on CT scan was performed in order to identify the location of the crossing vessel. Finally, retrograde pyelography performed in the operative room demonstrated upper pole calyx enlargement with a filling defect corresponding to a vascular impression on the infundibulum.

Surgical Procedure

A retroperitoneal pure laparoscopic approach was chosen. After placing the patient in the full-flank position, a 12-mm incision was made 1 cm above the iliac crest at the level of the Petit triangle. Abdominal wall and transversalis fascia were incised with scissors. Once the retroperitoneum was achieved, the space was dissected with the finger and expanded under direct vision by using a dilatation balloon. Two ports were inserted under digital guidance at the level of the anterior (10 mm) and posterior (5 mm) axillary lines. The third port (5 mm) was placed at the level of the tip of the 12th rib. Finally, a 12-mm Hasson port was placed at the level of the first incision so that ports were arranged in a diamond shape [6]. Retropneumoperitoneum was induced by carbon dioxide pressure fixed at 12 mm Hg.

The posterior para- and peri-renal fat was dissected to gain the kidney. The upper pole was identified. It appeared redundant due to the upper calyx enlargement. Renal sinus and vascular pedicle were identified and dissected. The renal pelvis appeared normal in size, but the superior calyx was enlarged due to an obstruction generated

by a crossing segmental vessel at the level of the calyceal infundibulum (Fig. 1).

The crossing vessel and the upper calyceal infundibulum were then dissected.

The calyceal infundibulum was secured by reabsorbable clips (Fig. 2) in order to avoid the risk of migration after the surgery. It was then sectioned, while the crossing vessel was preserved (Fig. 3).

A smooth dissection of the calyx was performed, without any clamping of segmental vascular branches, preserving the thin coating of renal parenchyma of the upper pole of the kidney.

The calyx was completely removed in order to avoid the risk of urinary fistulas. At the end of the extirpative phase, the upper pole sinusal cavity was examined in order to identify parenchymal structures like renal papillas, Bertin Columns, and interlobar vessels (Fig. 4). The interlobar vessels at this level were selectively coagulated avoiding intrasinus hematoma.

To complete the procedure, the cavity was wadded with the perirenal fat and fixed with PDS 2/0 suture in order to prevent the risk of bleeding and formation of urinary fistulas.

Results

Neither intra- nor postoperative complications were recorded. The patient was discharged 3 days after surgery. The CT scan performed one month postoperatively showed no enlargement of the urinary collecting system.

Discussion

Most of anatomic and radiographic studies of the renal arterial vasculature have devoted little attention to the relation of the renal vessels to the infundibula [7–9]. Graves [10] showed that the segmental artery directed to the upper pole of the kidney – a branch of the pre-pyelic division of the main renal artery – can overlies and compress the superior calyceal infundibulum. Tests and operative findings demonstrated that the vessels responsible for the filling defects were also causing significant obstruction to urine flow from the superior infundibulum to the renal pelvis. Indeed the symptoms were undoubtedly due to a periodic over-distension of the superior calyx by the urine. The stasis of urine in the calyx predisposes to infections and segmental pyelonephritis. The treatment of choice of such an anatomical defect

is represented by the upper pole partial nephrectomy. Notwithstanding the preservation of a huge portion of the healthy kidney, a relative loss of renal function is expected due to reversible ischemic injury that is caused when a surgery for the clamping of the arterial vasculature is performed; when a healthy portion of the kidney is removed together with the calyx; and when permanent ischemic damage of the parenchyma is involved in the resection bed suture.

In order to completely avoid the postoperative loss of renal function, new nephron-sparing techniques have been proposed. These techniques are based on the anatomical principle of the segmental distribution of the renal lobes (medullary pyramids and their own calyx). According to this concept, it is possible to describe a “pure” calycectomy, characterized by hilar access, renal sinus exploration, and isolation of a specific anatomical segment/lobe. The interlobar vessels located between different lobes should be considered independent from calyceal structures during the surgery. Indeed, if calycectomy is performed without the clamping of renal branches, the parenchymal ischemia is completely avoided. Moreover, the preservation of renal tissue surrounding the calyx leads to the preservation of the intrasinus segmental arteries flow, thereby avoiding their accidental closure by hemostatic sutures.

Conclusion

In conclusion, Laparoscopic Nephron-Sparing Calycectomy is a safe and effective surgical procedure for the treatment of Fraley's syndrome. If calycectomy is performed without the clamping of renal branches, parenchymal ischemia can be completely avoided. The preservation of renal tissue surrounding the calyx allows the preservation of the intrasinus segmental arteries flow, thereby avoiding their accidental closure by hemostatic sutures.

Ethics Statement

The participant of the study gave her informed consent to publish details of the case.

Disclosure Statement

None of the authors has anything to disclose.

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